Office of Energy Efficiency & Renewable Energy

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Innovation for Our Energy Future

Options for Alternative Fuels and Advanced Vehicles in Greensburg, Kansas

G. Harrow

Technical Report

NREL/TP-540-42748

May 2008

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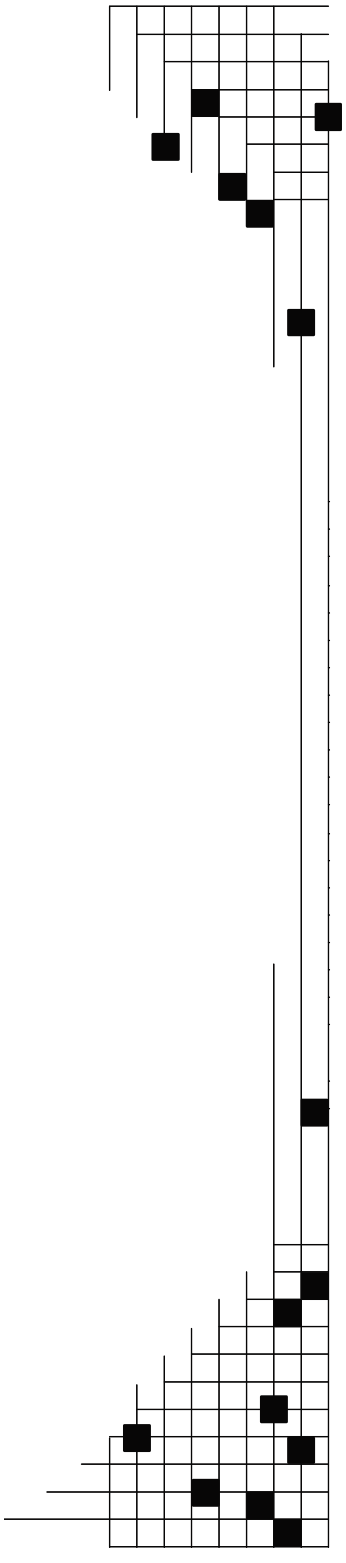

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Executive Summary

Shortly after a devastating tornado struck the city of Greensburg, Kansas, in May 2007, plans to rebuild Greensburg as a sustainable community began to evolve. The U.S. Department of Energy, the National Renewable Energy Laboratory, and other federal, state, and local agencies are working together to develop an integrated energy strategy to assist Greensburg City leaders in this endeavor. Design strategies for energy efficient commercial buildings, schools, and homes are being presented while options for reduction of petroleum consumption through alternative fuels and advanced vehicles, fuel blends, fuel economy, hybrid vehicles, and idle reduction are undergoing analysis.

This report focuses on laying out the key success factors of infrastructure, alternative vehicles, and alternative and renewable fuels. Because of the extensive efforts required to rebuild the entire city from the ground up, short-term recommendations for the transportation sector have been limited to technologies and fuels that will not require significant new businesses or major culture shifts at this time. In the long term, there are numerous transportation options such as idle reduction devices and electric and hybrid vehicles that should be considered. Information on both short- and long-term options is included in this report, although, some of the more multifaceted technology options are not currently being recommended.

A summation of key success factors for both the short- and long-term includes:

- Private and public commitments to the use of alternative fuels, advanced vehicle technologies, and petroleum reduction
- Adequate alternative fuel vehicle population and availability
- Sufficient alternative fuel fueling stations
- Competitive prices and incentives for alternative fuel vehicles (AFV), fuels, and technologies.

As part of this research, interviews were conducted with community members as well as a variety of public and private stakeholders including fleet owners, fueling station owners, refineries, and vehicle dealers.

The recommendations in this report should increase the potential for the successful use of alternative transportation technologies in Greensburg. They are based on the information collected in these interviews and supplemented with historical data.

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1. Introduction

Not long ago, Greensburg, Kansas, was nearly wiped off the map. In May 2007, Greensburg was hit by a fierce tornado that either destroyed or severely damaged the city's homes, commercial areas, a hospital, and many vehicles. The population of this city, which is also the Kiowa County seat, was more than 1,400 before the tornado struck. By the end of 2008, the population could be only half that many—about 700 people—according to some estimates.

But Greensburg is a city that refuses to give up. Its leaders and many of its citizens are committed to rebuilding Greensburg to be a model of sustainability for other cities and towns in rural America. To assist the city, the National Renewable Energy Laboratory (NREL) is working with the U.S. Department of Energy (DOE) and other federal, state, and local agencies to help Greensburg define its vision for rebuilding as a "green" city.

As of December 1, 2007, 44 businesses had made a commitment to rebuild there, and six new businesses had expressed interest in locating there, as well. Before the tornado, many of Greensburg's businesses depended on fleets of vehicles to carry out their day-to-day operations. Since the storm, the state has provided them with a number of older replacement vehicles. But many vehicles—and especially newer ones—are still needed.

As the city rebuilds its fleets, a number of officials have expressed considerable interest in using alternative fuels and associated alternative vehicle technologies. After many discussions with local leaders and consideration of the other higher priority projects that the community has to complete, recommendations to implement basic alternative fuels such as biodiesel, ethanol, CNG, and propane make the most sense short term. Hybrid electric vehicles are not being considered at this time because local dealerships do not currently sell or offer maintenance services for these types of advanced vehicles.

After the city and business infrastructure is in place and residential properties are rebuilt, other technologies such as idle reduction devices and electric and hybrid vehicles should be considered. To successfully incorporate alternative fuels and advanced technology vehicles in the city's rebuilding plan, the following factors will be key:

- Private and public commitments to the use of alternative fuels, advanced vehicle technologies, and petroleum reduction
- Adequate alternative fuel vehicle population and availability
- Sufficient alternative fuel fueling stations
- Competitive prices and incentives for AFVs, fuels, and technologies.

Selecting a short- and long-term portfolio of the most appropriate alternative fuels and vehicles for the area is also important in ensuring the success of those technologies in Greensburg. An appropriate long-term portfolio that includes all alternative fuels and advanced technologies, such as electric and hybrid vehicles and idle reduction devices will help the city and its citizens reduce both greenhouse gas (GHG) emissions and the city's dependence on foreign oil. Short term, biofuels and select other alternative fuels can

especially support the community if they are produced from locally grown crops and by using local, renewably generated power.

This report discusses implementation of biodiesel, electricity, ethanol, natural gas, and propane, which are all commercially available and, in the short term, could meet the majority of Greensburg's transportation needs without major business development. It briefly discusses some of the other advanced technologies available but, because of the longer timeframe required to implement these technologies, detailed deployment discussions were not included. The following information about these technologies can also be found on DOE's Energy Efficiency and Renewable Energy Alternative Fuels and Advanced Vehicles Data Center (AFDC) Web site (see *www.eere.energy.gov/afdc/fuels/index.html),* and it is reprinted here. Readers can use the links to obtain more information.

Biodiesel (*http://www.eere.energy.gov/afdc/fuels/biodiesel.html*)

Biodiesel is a renewable alternative fuel produced from a wide range of vegetable oils and animal fats. Pure biodiesel is compatible with most diesel engines and is commonly blended with petroleum diesel. Blends like B5 (5% biodiesel, 95% diesel), currently being used by the Kansas Department of Transportation in Greensburg, are becoming increasingly common as fleets and drivers become more aware of the many benefits. Biodiesel blends up to B20 (20% biodiesel and 80% diesel) are becoming more widely available and can be implemented using current infrastructure.

Electricity (*www.eere.energy.gov/afdc/fuels/electricity.html*)

Greensburg is considering renewable electricity generation options using wind power. This renewable energy can be used to power electric vehicles directly from the power grid. Electric vehicles (EVs) store electricity in an energy storage device, such as a battery. The electricity powers the vehicle's wheels by means of an electric motor. Due to current battery technology and vehicle design limitations, EVs have limited energy storage capacity and driving range. Some EVs replenish the electricity with onboard chargers; others plug into a charger located outside the vehicle. There are currently no light-duty electric vehicles available from major auto manufacturers. Neighborhood electric vehicles (NEVs), on the other hand, are being manufactured by a variety of companies. These small vehicles are ideal for a city the size of Greensburg and are commonly used for municipal tasks, neighborhood commuting, light hauling, and delivery. Their use is limited to areas with 35 mph speed limits or for off-road service.

Ethanol (*www.eere.energy.gov/afdc/fuels/ethanol.html*)

Ethanol is a renewable transportation fuel primarily made today from starch crops, such as corn. It can also be made from sugar beets and cane or cellulosic materials, such as corn stover and wheat straw. Nearly one-third of U.S. gasoline used in conventional vehicles contains ethanol in a low-level blend to reduce air pollution. E85 (85% ethanol, 15% gasoline) is considered an alternative fuel and is used to fuel E85-capable flexible fuel vehicles (FFVs), which are available in a variety of models from U.S. and foreign automakers. FFVs are capable of operating on gasoline, E85, or a mixture of both using a single fueling system. Other than fueling capability and corrosion-resistant components, FFVs are similar to their conventional gasoline counterparts. Power, acceleration, payload, and cruise speed are comparable whether running on ethanol or gasoline. The only noticeable

difference is that fuel economy is lower when FFVs run on ethanol because of its lower energy content. However, if priced correctly, E85 has an equivalent cost per mile.

Natural Gas (*www.eere.energy.gov/afdc/fuels/natural_gas.html*)

Natural gas is a domestically produced alternative fuel and is readily available to end users through the utility infrastructure. Most natural gas is extracted from gas and oil wells with much smaller amounts derived from supplemental sources such as synthetic gas, landfill gas and other biogas resources, and coal-derived gas. Dedicated natural gas vehicles (NGVs) are designed to run only on natural gas; bi-fuel NGVs have two separate fueling systems that enable the vehicle to use either natural gas or a conventional fuel (gasoline or diesel). Natural gas vehicles are fueled with compressed natural gas (CNG) or liquefied natural gas (LNG). The driving range of NGVs generally is less than that of comparable gasoline- and diesel-fueled vehicles because of the lower energy content of natural gas. NGV horsepower, acceleration, and cruise speed are comparable with those of an equivalent conventionally-fueled vehicle. Light-duty natural gas vehicles work much like gasoline-powered vehicles with spark-ignited engines. Some heavy-duty vehicles use spark-ignited natural gas systems, but other systems exist as well. High-pressure direct injection engines burn natural gas in a compression-ignition (diesel) cycle. Heavy-duty engines can also burn diesel and natural gas in a dual-fuel system. Several light-duty and heavy-duty natural gas vehicles are available from manufacturers or certified conversion companies. (Note that conversions must be performed by companies that have received approval from the Environmental Protection Agency). A CNG powered Honda Civic and a FuelMaker FMQ-2-36 CNG refueling station were recently donated to Greensburg. See also *www.fuelmaker.com/Products/NaturalGasRefueling/ProductSpecifications*.

Propane (*www.eere.energy.gov/afdc/fuels/propane.html*)

Propane, also known as liquefied petroleum gas (LPG), is used by many fleets. It is produced as a by-product of natural gas processing and crude oil refining. Propane has a high energy density, high octane rating, and excellent properties for spark-ignited internal combustion engines. Propane vehicles work much like gasoline-powered vehicles with spark-ignited engines. Depending on the system, a vapor mixture of propane and air or liquid propane is drawn or injected into the combustion chamber where it is burned to produce power, just like gasoline. The Southern Plains Co-op has a propane refueling station in Greensburg. As with CNG, there are several certified propane light- and heavy-duty conversions that are available.

Hybrids (*www.eere.energy.gov/afdc/vehicles/hybrid_electric.html*)

Hybrid electric vehicles (HEVs) typically combine the internal combustion engine of a conventional vehicle with the battery and electric motor of an electric vehicle. HEVs combine the benefits of high fuel economy and low emissions with the power, range, safety characteristics, and convenience of conventional diesel and gasoline fueled vehicles. Future offerings might also include plug-in hybrid electric vehicles that could take advantage of available public or private charging facilities. Hybrid electric vehicles can be cost competitive with similar conventional vehicles. What cost premiums there are for HEVs can be offset by fuel cost savings and tax incentives. There are numerous original equipment manufacturers that offer light duty hybrid vehicles. Various manufacturers currently offer medium and heavy duty hybrid vehicles including delivery vehicles, buses, and refuse trucks.

Idle Reduction (*www.eere.energy.gov/afdc/vehicles/idle_reduction.html*)
Idle reduction (IR) technologies and practices are an important way to cut petroleum consumption and emissions. IR is typically used to describe technologies and practices that reduce the amount of time vehicles idle their engines. Reducing idle time saves fuel, engine wear, and money while reducing emissions and noise. A variety of technologies are employed to reduce this fuel use. Onboard equipment such as automatic engine stop-start controls and auxiliary power units can be used. Additional strategies are available for light- and medium-duty vehicles and school buses.

2. Public and Private Commitments to Alternative Fuels

In December 2007, NREL conducted extensive interviews with members of the Greensburg community. Both public and private fleets indicated support for alternative fuels—if they were cost competitive, operationally similar to conventional fuels, and readily available. The use of biofuels, such as E85 and biodiesel, was noted several times in the interviews as a way to support the local agricultural economy. Questions and concerns were raised about the relative merit of biofuels, and many of these inquiries were addressed during the interviews.

3. Vehicle Numbers and Availability

From the Greensburg fleet interviews, combined with data obtained from R.L. Polk & Co., we concluded that, before the tornado struck, there were approximately 4,000 vehicles within a 30-mile radius of Greensburg. The vehicles included 100 FFVs, 300 diesel on-road vehicles, and 3,600 gasoline-fueled vehicles. The current vehicle population is more difficult to ascertain, because a significant number of residents have not returned to Greensburg, damaged vehicles have not been permanently replaced, and fleet owners are trying to assess their future needs before acquiring new vehicles.

After the tornado, the Greensburg Chevrolet dealer relocated to a temporary facility and continues to sell and maintain FFVs. A Ford dealership approximately 30 miles away in Pratt also sells FFVs. There is currently no local support infrastructure to provide, maintain, and repair hybrid, electric, or natural-gas-fueled vehicles.

4. Fuel Supplies and Pricing

The three Greensburg fueling stations— Kwik Shop, Southern Plains Co-op, and Volz Oil—provide various blends of gasoline, diesel, and dyed diesel. Kiowa County and the Kansas Department of Transportation also maintain multiple fuel tanks for vehicle refueling. When the interviews were conducted, there were no E85 or biodiesel refueling stations, but all of the fuel providers indicated that their suppliers could provide them with both fuels. There were also no publicly available electric charging stations.

Changes are on the way, however. For example, a FuelMaker CNG refueling station was recently donated to the city and the Southern Plains Co-op plans to install a credit card reader at their propane refueling station. For an up-to-date listing of the Greensburg area's alternative fuel stations, see the AFDC's Alternative Fueling Station Locator at *http://afdcmap2.nrel.gov/locator*. Using the station locator, you can search the Greensburg

area to find stations offering compressed natural gas, liquefied petroleum gas, E85, electricity, biodiesel, hydrogen, and liquefied natural gas. The results are displayed in a map with details about each station.

Even when an alternative fuel is available, cost-competitive pricing is critical to its successful use. During the 2007 interviews, station owners indicated that the wholesale cost of biodiesel and ethanol was not competitive with that of conventional diesel and gasoline. A CNG/gasoline cost comparison supplied by Kansas Gas Service (Appendix D) indicates that CNG costs significantly less than unleaded gasoline, however, on a gasoline gallon equivalent basis.

A successful approach to obtaining biodiesel and ethanol at a favorable price is to negotiate long-term contracts directly with local fuel producers. This approach reduces transportation charges, potentially eliminates fuel marketer fees, and provides support to local production facilities that purchase feedstocks, such as soybeans and corn.

There are two local producer options for ethanol in the area. The Gateway Ethanol plant in Pratt is in the initial startup phase and should be producing within a few months, if it is not already doing so. Noble Americas, representing Gateway, indicated that it would be interested in supplying E85 to facilities in Greensburg. Also, Kwik Shop has been purchasing E85 for one of its Wichita stations from Abengoa Bioenergy Corporation in Colwich, Kansas. Abengoa Bioenergy New Technologies currently has a grant from DOE to produce ethanol from cellulosic materials. This might provide both a short-term option for corn-based ethanol as well as a longer term option for cellulosic ethanol. Recently, Torsten Energy announced that it would be building a biodiesel plant in Greensburg. Several plants could be in production within three to four years. No additional local biodiesel producers have been identified.

The 2007 interviews also indicated that the approximate annual volume of transportation-related fuel being obtained at current Greensburg fueling sites amounts to 1.6 million gallons of gasoline; 300,000 gallons of on-road, clear diesel; and 115,000 gallons of off-road, dyed diesel. At the time of this report, the numbers from Volz Oil had not been confirmed.

Table 1. Estimated Vehicle Fuel Consumption in Greensburg (gallons per year)

	Gasoline	Diesel	E85	CNG	Propane
Municipal and Retail Locations	1,600,000	415,000	0	0	0

5. Fueling Locations

The economics of dispensing alternative fuels must be sustainable over the long term. Economic sustainability will be affected by the local vehicle population, the commitment of vehicle owners to use alternative fuels, and the cost of installing fueling equipment, such as tanks and dispensers.

As mentioned earlier, both diesel vehicles and FFVs are currently operating in the Greensburg area. In the 2007 interviews, most fleet owners indicated that B20 is operationally viable for their diesel vehicles and that they could mandate its use if it were cost competitive with #2 diesel. However, private vehicle owners would be the primary purchasers of E85, and it could take some time and education to change their behaviors in this regard. The fleets that currently include FFVs, or are considering purchasing them, indicated that they would probably refuel with E85 when it is offered at competitive prices.

Station owners reported that they have received estimates of $60,000 to $70,000 to add E85 equipment. If the owner qualifies for it, Kansas currently offers a 40% tax credit for this. There is also a 30% federal tax incentive for increasing the alternative fuel infrastructure (see Appendix C for more on infrastructure tax incentives). All the fuel providers interviewed expressed interest in supporting alternative fuels and the associated infrastructure if the business case supports the investment and the fuel is available at a competitive price.

Calculations made using the NREL E85 Business Case model and estimated FFV populations suggest that adding an E85 capability to existing stations might be feasible (see Appendix B for specific calculations used in the Greensburg scenarios). Additional information, including assumptions and calculation methods used in the business case, can be found at *www.eere.energy.gov/afdc/fuels/ethanol_business.html*.

Further studies need to be conducted to better understand the business cases for all alternative fuels. If other sources of funding can be found to help build an alternative fuel infrastructure in Greensburg, the economic viability of this option will be enhanced.

6. Incentives for Alternative Fuels & Alternative Fuel Vehicles

Numerous federal and state incentives promote the use of alternative fuels and the acquisition of alternative fuel vehicles in Kansas, and many could be applicable in Greensburg. Incentives for alternative fuels usually fall into the following categories: fuel infrastructure credits, vehicle credits, fuel tax credits, and fuel production credits.

For example, if one of the stations in Greensburg added an E85 or B20 biodiesel dispenser that cost $70,000, it could be eligible for a 30% federal tax credit ($21,000) and a 40% Kansas state tax credit ($28,000), depending on its tax liability. This would result in an out-of-pocket cost for the dispenser of $21,000.

Appendix C of this report and the Incentives and Laws section of the AFDC site (*www.eere.energy.gov/afdc/incentives_laws.html*) describe various federal incentives for alternative fuels and vehicles as well as state incentives available in Kansas.

7. Recommendations

The Greensburg community faces many challenges, including projecting its future population to help determine transportation needs, vehicle replacements, and the viability of transportation-focused businesses. The city's size and makeup will have a direct effect on its successful implementation of alternative fuels and advanced-technology vehicles.

The following recommendations should increase the potential for the successful use of alternative transportation technologies in Greensburg. They are based on the information we collected during the December 2007 interviews and supplemented with historical data.

7.1 General Recommendations

1. Encourage major fleet operators in Greensburg to work with the business community to develop an optimum fuel supply infrastructure. If station owners can depend on a base level of fuel purchases from fleet operators, the business case becomes much more favorable despite the city's relatively small size.

2. Encourage the Chamber of Commerce to work with Greensburg Greentown and city and county leadership to establish a green transportation subcommittee that would be the primary group for developing and implementing transportation recommendations.

7.2 Public and Private Commitment to Alternative Fuels and Petroleum Reduction

1. Hold a joint meeting with key fleets and station owners to assess, solicit, and gain support for biofuels. With commitments from fleets located in Greensburg and the surrounding area, this group would work with local fueling businesses to build up the alternative fuel infrastructure.

2. Hold educational events to provide a forum for fleets and the public. Several participants expressed significant interest in alternative fuels during the 2007 interviews, and many of them asked questions related to biofuels and advanced-vehicle technologies. Educational events can serve as a platform for obtaining the community's support. In addition, consider holding training sessions with drivers in the fleets that commit to using alternative fuels and vehicles.

3. Develop fleet recognition and incentive programs for drivers. For example, hold a monthly drawing for a $20 gift card awarded randomly to a driver that has filled his or her vehicle with biofuel. For privately owned vehicles used in fleets, reimburse an additional $50 per month for a driver who uses an alternative fuel in his or her FFV rather than a conventionally fueled vehicle.

4. Discuss the possibility of using B20 in Greensburg with the Kansas Department of Transportation.

5. Consider adding idle-reduction technologies to vehicles, such as school buses, that spend a significant amount of time idling.

7.3 Vehicle Population and Availability

1. Consider implementing a purchasing policy for the City of Greensburg and Kiowa County that requires agencies to purchase alternative fuel and an advanced-technology vehicle, when they are locally available, for a vehicle application that is being added or replaced.

2. Conduct an in-depth analysis of vehicles that have to be replaced or added to municipal and private fleets. Determine the pricing differential for purchasing alternative fuel and advanced-technology vehicles. Solicit and establish a fund to help offset any incremental costs for alternative fuel or advanced-technology vehicles.

3. Explore the feasibility of purchasing neighborhood electric vehicles for city and county employees, such as building inspectors and meter readers, who use vehicles primarily in the city.

4. Conduct an analysis of the cost of installing public electric recharging stations throughout Greensburg. Based on the analysis and the projected population of electric vehicles, consider including recharging stations in the master plan to encourage businesses and residents to use electric vehicles for their in-town activities.

5. Complete the business case for adding a neighborhood electric vehicle dealership in Greensburg. If the volume of sales and service would support this type of dealership, solicit seed funding and work with the local dealership to get it started. Global Electric Motorcars, LLC, one of the electric car companies contacted for this analysis, reported that it would cost approximately $60,000 in initial vehicle inventory, parts, and fees to start a new dealership.

6. Explore the feasibility of locating a hybrid electric vehicle dealership in Greensburg. Contact dealerships in the area that currently offer hybrids and assess their interest.

7. Explore the availability of CNG and propane vehicles and options for refueling multiple vehicles at a donated CNG refueling station.

7.4 Fuel Supply and Pricing

1. Study E85 and biodiesel pricing structures from current suppliers. Determine local pricing strategies and their impact on fuel sales.

2. Continue to pursue alternative fuel supply options and contracts with local biofuel producers.

7.5 Fueling Locations

1. Solicit grants or donations to cover the initial cost of upgrading the existing fueling infrastructure to include biofuels. Station owners in Greensburg estimated that costs would be $70,000 per station for E85 or B20, not including any tax incentives. That amount includes the cost of a new tank, a dispenser, and other equipment needed to make the fuels available to the public. If all available federal and Kansas state alternative fuel infrastructure tax credits applied, the out-of-pocket costs and funding required would be approximately $21,000 per fuel per location.

2. Maximize the use of alternative fuels in local fleets whenever possible by purchasing new alternative fuel vehicles and using E10 and B5 in conventional vehicles.

8. Challenges

The challenges that Greensburg faces in adopting green transportation technologies include:

- Predicting the future vehicle population
- Ensuring the availability of alternative fuels at competitive prices
- Covering the cost of replacing current or lost vehicles with alternative fuel vehicles, which includes obtaining outside funding
- Developing the infrastructure required for alternative fuels and advanced vehicles.

9. Potential Economic Development Opportunities

Opportunities in Greensburg for economic development associated with alternative fuels and vehicles include these:

- Providing sales and services for electric vehicles
- Building an infrastructure for biodiesel
- Building an infrastructure for E85
- Providing maintenance and other support for CNG and Propane-fueled vehicles
- Providing sales, services, and support for hybrid electric vehicles
- Providing sales, installation, and other services for idle-reduction technologies.

Appendix A

Stakeholder Fleets
Successful implementation of alternative fuels within an area is directly affected by local fleet support for those fuels. If the station owners can depend on a base level of fuel purchases from these fleets, the business case becomes much more favorable. To assess the support for alternative fuels in Greensburg, the stakeholder fleets were contacted and estimated vehicle numbers and fuel usage was obtained. It needs to be emphasized that these numbers are estimates based on the best information available at the time.

City of Greensburg
Contact: Pam Reeves, treasurer
Vehicles: 10 light-duty gasoline
Two light-duty diesel
Two medium- and heavy-duty diesel trucks
Fuel Supplier: Volz Oil
Southern Plains Co-op

Kiowa County
Contacts: Kiowa County Commissioner, Gene West
Sheriff Department, Galan Marvel
Road and Bridge, Doyle Conrad
Fire Department, Chance Little, Jay Kane
Weed Department, Reed Foster
Emergency Services, Kendal Lothman
Vehicles: 21 light-duty gasoline
Four light-duty diesel
Eight medium- and heavy-duty diesel trucks
>20 off-road diesel equipment
Fuel Supplier: Volz Oil

John Deere Dealership
Contact: Kelly Estes, president
Mike Estes, Greensburg store manager/sales
Vehicles: 18 private vehicles reimbursed by the company
75 diesel vehicles between four stores
Fuel Supplier: Volz Oil
Southern Plains Co-op

School System

Contact: Darin Headrick, school superintendent
Vehicles: One FFV Chevrolet Impala, 30,000 miles per year
2 FFV Suburbans, 20,000 miles per year
Five passenger vans (will be replaced with six or seven FFV or hybrid Suburbans)
One motor coach (would consider idle reduction for this and other units)
One Kubota diesel 4-wheeler
Future - may look at a 66 passenger school bus
Fuel Supplier: Southern Plains Co-op

Iroquois Center for Human Development

Contact: Shelton Carpenter, executive director
Vehicles: 25 light-duty
Fuel Supplier: Volz Oil
Southern Plains Co-op

Hospital

Contact: Mary Sweet, administrator
Vehicles: Two diesel ambulances (24,000 miles per year)
Maintenance ½ ton pickup (7,000 miles per year)
2001 Dodge Cargo van (not currently in use)
Fuel Supplier: Southern Plains Co-op

Southern Plains Co-op

Contact: Ron Gruber
Vehicles: Six gasoline pickups
Six tender trucks
Six applicator trucks
Two propane delivery trucks
Fuel Supplier: Southern Plains Co-op

Kansas Department of Transportation vehicles located in Greensburg

Contact: Gary Jarvis
Vehicles: Three diesel trucks
Two pickups
Multiple off-road vehicles (graders, loaders, and a backhoe)
Fuel Supplier: Volz Oil, Moeder or Hampel (depending on lowest bid)

Vehicle Providers

The local Chevrolet dealer, Ron Shank of Dwane Shank Motors, Inc., currently orders and stocks FFVs when the models are available in FFV versions. He does not make a concerted effort to stock used FFVs. General Motors (GM) is assisting him in building a "Green" dealership which includes energy efficiency improvements, solar, and wind generation. He is interested in electric vehicles and believes that, in certain applications, it is a good choice for Greensburg.

Lanterman Motors is a Ford dealership located approximately 30 miles away in Pratt. When contacted, they said that they currently sell a limited number of FFVs and do not sell or service the Ford Escape hybrid.

Schofield Honda, a dealership in Wichita approximately 90 miles away, donated a Honda GX and a FuelMaker CNG refueling station.

There are no local businesses that currently provide maintenance and service for alternative vehicle technologies such as electric, hybrid, natural gas, and propane. The GM dealer is not open to providing that service due to the retraining and equipment costs associated with supporting other OEM vehicles.

Infrastructure
The city currently has two publicly available fueling sites that were quickly rebuilt after the tornado: the Southern Plains Co-op and the Kwik Shop (a part of the Dillons chain and ultimately tied to Kroger). They both offer unleaded and diesel fuel. In addition to these two sites, many of the businesses and fleets purchase their fuel from Volz Oil.

Southern Plains Co-op	Three tanks (6,000 gallon red diesel, 6,000 gallon clear diesel, and 8,000 gallon unleaded), two dispensers, propane filling station
Kwik Shop	Three tanks (10,000 gallons unleaded, 10,000 gallons premium, and 10,000 gallons diesel), three dispensers
Volz Oil	No data available at this time

Kiowa County Road & Bridge department had four bulk refueling tanks before the tornado: two 500-gallon unleaded, one 8,000-gallon clear diesel, and one 8,000-gallon red diesel. They are currently using three 1,000-gallon tanks for red diesel, one 8,000-gallon tank for clear diesel and one 1,000-gallon tank for unleaded.

The state of Kansas fleet in Greensburg has a 2,000-gallon diesel tank that is filled with B5. The district office in Hutchinson sets the guidelines for fuel use including biodiesel mixtures.

There are no mentioned fire jurisdictions. The city controls what is within its boundaries and the county indicated that people could do whatever they wanted in the county.

According to NREL's Alternative Fuels Data Center in December 2007, within 90 miles of Greensburg there is no biodiesel available; five stations offer E85 (closest one is 24 miles away in Offerle, Kansas), one station offers CNG (64 miles away in Alva, Okla.), and 11 additional stations offer propane (closest one is 30 miles away in Pratt, Kansas).

Fuel Availability
There is an existing ethanol plant in Pratt, Kansas, (30 miles) and one in Dodge City (60 miles). On December 3, 2007, there was an announcement that a biodiesel plant will be built

in Greensburg. It appears that biodiesel from this facility will be available in approximately three years.

The co-op has access to biodiesel from Cenex, their fuel provider, and has considered offering it to their customers. Up until now, pricing, in addition to the infrastructure costs, has prevented them from offering B20. Pricing available to them on December 6, 2007 was $4.37 per gallon of pure biodiesel and $2.57 per gallon of #2 diesel. Nationwide at the end of November, 2007, E85 pricing was 18% lower than unleaded (EPIC data).

There is an abundance of natural gas in the area and propane was previously used in transportation and for powering irrigation wells. Both have been declining in use.

Idle Reduction

City, county and school vehicles that require significant idling could be up-fitted with idle reduction devices. Idle reduction devices can cost from $700 for a simple light-duty application to over $7,000 for certain heavy-duty vehicle applications.

Appendix B

Calculations using the NREL E85 Business Case model and estimated FFV populations indicate that the required gross margin to give a 10% expected rate of return would range from $0.13 per gallon for 93,000 gallons of E85 sold per year (assumes all vehicles fill up 100% of the time with E85 in Greensburg at one station) to $0.58 for 16,000 gallons of E85 sold per year (assumes 100% of the vehicles fill up 50% of the time with E85 at three stations in Greensburg).

The required gross margin for E85 would be significantly lower if outside funding would pay a portion of the out-of-pocket expenses associated with adding the necessary equipment to provide infrastructure. Gross margin is defined as the money the retailer needs to make on each gallon of E85 sold. For more detailed information on the E85 Business Case and its assumptions, go to *www.eere.energy.gov/afdc/fuels/ethanol_business.html*.

Appendix C

The following information is taken directly from DOE's EERE Alternative Fuels & Advanced Vehicles Data Center at *www.eere.energy.gov/afdc/progs/fed_summary.php/afdc/US/0*.

United States (Federal) Incentives and Laws

Alternative Fuel Infrastructure Tax Credit

Section 1342 of the Energy Policy Act of 2005 provides a tax credit equal to 30% of the of cost alternative refueling property, up to $30,000 for business property. Qualifying alternative fuels are natural gas, propane, hydrogen, E85, or biodiesel mixtures of B20 or more. Buyers of residential refueling equipment can receive a tax credit for $1,000. For non-tax-paying entities, the credit can be passed back to the equipment seller. The credit is effective on equipment put into service after December 31, 2005. It expires December 31, 2009 (hydrogen property credit expires in 2014).

This legislation also extends the Tax Deduction Timeline that was established by EPAct 1992, Section 179, and extended by the Working Families Tax Relief Act of 2004.

In May 2006, the Internal Revenue Service (IRS) published Form 8911, which provides a mechanism to claim the infrastructure tax credit. Owners who install qualified refueling property on multiple sites can utilize the credit for each property. The instructions define what is considered qualified property and the value of the credit. See IRS Form 8911 at *www.irs.gov/pub/irs-pdf/f8911.pdf*.

Alternative Motor Vehicle Credit

Section 1341 of the Energy Policy Act of 2005 provides a tax credit to buyers of new AFVs placed in service as an alternative fuel vehicle after January 1, 2006. The legislation provides for a tax credit equal to 50% of the incremental cost of the vehicle, plus an additional 30% of the incremental cost for vehicles with near-zero emissions (SULEV or Bin 2 for vehicles <14,001 lb GVWR). The IRS has issued two notices to establish rules for manufacturers and qualified vehicle buyers to claim the credit. The Current Tax Credits table at *www.eere.energy.gov/afdc/vehicles/hybrid_electric_tax_credits.html* has information on certified vehicles and available credits.

The credit is available on the purchase of light-, medium, and heavy-duty vehicles and fuel-cell, hybrid, and dedicated natural gas, propane, and hydrogen vehicles. Light-duty lean burn diesel vehicles are also eligible.

Vehicles are subject to the following incremental cost limitations:

- $5,000: 8,500 GVWR or lighter
- $10,000: 8,501 - 14,000 GVWR
- $25,000: 14,001 - 26,000 GVWR
- $40,000: 26,001 GVWR and heavier

For non-tax-paying entities, the credit can be passed back to the vehicle seller. The tax credit can be applied to vehicle purchases made after December 31, 2005. The credit expires December 31, 2010.

IRS Notice 2006-9 (*www.irs.gov/pub/irs-drop/n-06-09.pdf*), issued in January 2006, establishes procedures for manufacturers to certify to the IRS that a vehicle meets requirements to claim the credit and the amount of the credit for which the vehicle is eligible.

IRS Notice 2006-54 (*www.irs.gov/pub/irs-drop/n-06-54.pdf*), issued in June 2006, extends the Qualified Alternative Fuel Motor Vehicle (QAFMV) tax credit to vehicle conversions. This IRS guidance states that new or used vehicles, placed in service as AFVs after January 1, 2006, qualify for the tax credit when the conversion system manufacturer has received a certificate of conformity from the EPA or California Air Resources Board. This guidance also establishes that manufacturers (conversion system installers) must provide certification to the IRS that a vehicle is eligible for a tax credit. The IRS must then provide the manufacturer with acknowledgement that a vehicle qualifies for the credit. The credit is taken by the buyer of a vehicle, and IRS Form 8910 should be used to claim the credit. The credit cannot be sold or transferred but can be carried forward by the seller for use in later years.

This legislation replaces the Clean Fuel Vehicle Property Tax Deduction previously available to purchasers.

Hybrid Motor Vehicle Credit

Section 1341 of the Energy Policy Act of 2005 provides a tax credit for light-duty hybrid vehicles (<8,501 lb GVWR) based on their improved fuel economy and their life-time fuel savings potential. The IRS will certify vehicles for the credit and publish qualifying credit amounts as vehicles are certified. The Current Tax Credits table has the most recent information from the IRS.

The fuel economy portion of the credit is based on the following efficiency gains over model year 2002 baselines.

- 125%-149%: $400
- 150% -174%: $800
- 175%-199%: $1,200
- 200%-224%: $1,600
- 225%-249%: $2,000
- 250%+: $2,400

The conservation credit increases the fuel economy credit based on lifetime fuel savings:

- 1,200-1,799 gal: $250
- 1,800-2,399 gal: $500
- 2,400-2,999 gal: $750
- 3,000 gal+: $1,000

To qualify for the credits, the vehicles must meet at least Bin 5 standards if they are up to 6,000 lb GVWR, or Bin 8 standards if the vehicles are 6,001 lb-8,500 lb GVWR.

Heavy-duty hybrid vehicles are subject to the following incremental cost limitations:

- <14,001 GVWR: $7,500
- 14,001-26,000 GVWR: $15,000
- 26,001+ GVWR: $30,000

This tax credit replaces the tax deduction previously available to purchasers under the Clean Fuel Vehicle Property guidance. This tax credit expires December 31, 2010.

The IRS issued guidance to automobile manufacturers in January 2006. Specifically, this notice provides procedures for a vehicle manufacturer to certify to the Internal Revenue Service both that the vehicle meets certain requirements for the credit and information to calculate the amount of the credit allowable with respect to that vehicle. See Notice 2006-9 at *www.irs.gov/pub/irs-drop/n-06-09.pdf*.

Clean School Bus USA

Clean School Bus USA reduces operating costs and children's exposure to harmful diesel exhaust by limiting bus idling, implementing pollution reduction technology, improving route logistics, and switching to biodiesel. In fiscal year 2005, the program offered $7.5 million in cost-shared grants to help school districts upgrade their diesel fleets. The Energy Bill of 2005 utilizes this EPA program to grant up to 50% cost share (depending on the age and emissions of original bus) to replace school buses with ones that operate on alternative fuels or low-sulfur diesel, or up to 100% for retrofit projects. $55 million are authorized for both 2006 and 2007, and "such sums as necessary" for 2008-2010. More information is available on the Clean School Bus USA site at *www.epa.gov/cleanschoolbus/index.htm*.

Biodiesel and Ethanol (VEETC) Tax Credit

The American Jobs Creation Act of 2004 (Public Law 108-357) created tax incentives for biodiesel fuels and extended the tax credit for fuel ethanol. The biodiesel credit is available to blenders/retailers beginning in January 2005. It also established the Volumetric Ethanol Excise Tax Credit (VEETC), which provides ethanol blenders/retailers with $.51 per pure gallon of ethanol blended or $.0051 per percentage point of ethanol blended (i.e., E10 is eligible for $.051/gal; E85 is eligible for $.4335/gal). The incentive is available until 2010.

Section 1344 of the Energy Policy Act of 2005 extended the tax credit for biodiesel producers through 2008. The credits are $.51 per gallon of ethanol at 190 proof or greater, $1.00 per gallon of agri-biodiesel, and $.50 per gallon of waste-grease biodiesel. If the fuel is used in a mixture, the credit amounts to $.0051 per percentage point ethanol or $.01 per percentage point of agri-biodiesel used or $.0050 per percentage point of waste-grease biodiesel (i.e. E100 is eligible for $.51 per gallon).

For more information, read IRS Form 637 (*www.irs.gov/pub/irs-pdf/f637.pdf*) and IRS publication 510 (*www.irs.gov/pub/irs-pdf/p510.pdf*).

Non-Urbanized Area Formula Program

The Non-Urbanized Area Formula Program assists in the maintenance, development, improvement, and use of public transportation systems in rural and small urban areas; helps people in non-urbanized areas get transportation to health care, shops, school, employment, pubic services, and recreation; assists in the development and support of intercity bus transportation; and more. The program provides funding for capital, operating, and administrative purposes to state and local governments, non-profit organizations, and public transit operators. For more information, read the Federal Transit Administration's FY 2007 Budget Request at *www.irs.gov/pub/irs-pdf/p510.pdf* or call the Federal Transit Administration's Office of Resource Management and State Programs at (202) 366-2053.

Kansas Incentives and Laws

Last Updated May 2007

The following information is taken directly from DOE's EERE Alternative Fuels & Advanced Vehicles Data Center and can be accessed by going to *www.eere.energy.gov/afdc/incentives_laws.html* and clicking on the state of Kansas on the map.

Kansas is the proud home of the Kansas City Regional Clean Cities Coalition (www.kcenergy.org/transportation.html). Coordinator contact information is listed below.

Alternative Fuel Refueling Infrastructure Tax Credit

The state offers an income tax credit for alternative fuel refueling stations placed in service after January 1, 2005, and before January 1, 2009. The tax credit, worth up to 40% of the total amount, may not exceed $160,000. For any refueling station placed in service after January 1, 2009, the amount may not exceed $100,000. This tax credit should be deducted from the taxpayer's income tax liability for the taxable year in which the expenditures are made. In the event the credit is more than the taxpayer's tax liability for that year, the remaining credit may be carried over for up to three years after the year in which the expenditures were made.

Point of Contact

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Renewable Fuel Retailer Incentive

Beginning January 1, 2009, a licensed retail motor fuel dealer may receive a quarterly incentive for selling and dispensing renewable fuels, including biodiesel. Qualified motor fuel dealers are eligible for up to $0.065 for every gallon of renewable fuel sold and up to $0.03 for every gallon of biodiesel sold, if the required threshold percentage is met. The threshold

percentage for the incentive payment will increase on an annual basis from 10% for renewable fuel and 2% for biodiesel in 2009 to 25% beginning on January 1, 2024. Funds will be allocated from the Kansas Retail Dealer Incentive Fund.

'Biodiesel' is defined as a renewable, biodegradable, mono alkyl ester combustible liquid fuel derived from vegetable oils or animal fats that meets the specifications adopted by rules and regulations of the Secretary of Agriculture pursuant to current law. The specification must meet the American Society for Testing and Materials (ASTM) specification D6751-07 for biodiesel fuel (B100) blend stock for distillate fuels, but may be more stringent regarding biodiesel quality and usability. 'Renewable fuels' are defined as combustible liquids derived from grain starch, oil seed, animal fat, or other biomass; or produced from biogas source, including any non-fossilized, decaying, organic matter which is capable of powering spark ignition machinery.

Point of Contact

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Alternative Fuel Vehicle (AFV) Tax Credit

The state offers an income tax credit worth up to 40% of the incremental or conversion cost for qualified AFVs placed into service after January 1, 2005, as outlined in the chart below. Qualified AFVs include vehicles that operate on a combustible liquid derived from grain starch, oil seed, animal fat, or other biomass, or produced from a biogas source.

GVWR	Credit
Less than 10,000 lbs.	Up to $2,400
10,000 to 26,000 lbs.	Up to $4,000
Over 26,000 lbs.	Up to $40,000

Alternatively, a tax credit in an amount not to exceed the lesser of $750 or 5% of the cost of the AFV is available to a taxpayer who purchases an original equipment manufacturer AFV. This credit is allowed only to the first individual to take title of the vehicle. For motor vehicles capable of operating on E85, the individual claiming the credit must provide evidence of purchasing at least 500 gallons of E85 between the time the vehicle was purchased and December 31 of the next calendar year. This tax credit should be deducted from the taxpayer's income tax liability for the taxable year in which the expenditures are made. In the event the credit is more than the taxpayer's tax liability for that year, the remaining credit may be carried over for up to three years after the year in which the expenditures were made.

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Biodiesel Production Incentive

A biodiesel fuel production incentive is available in the amount of $.30 per gallon of biodiesel fuel sold by a qualified Kansas biodiesel fuel producer. The incentive is payable to producers from the Kansas Qualified Biodiesel Fuel Producer Incentive Fund. Funding will be made available for the production of biodiesel fuel beginning July 1, 2007.

Ethanol Production Incentive

The Kansas Qualified Agricultural Ethyl Alcohol Producer Fund enables qualified agricultural ethyl alcohol producers to apply for a production incentive with the Department of Revenue. If an ethyl alcohol producer who was in production prior to July 1, 2001, increases production capacity by an amount of 5,000,000 gallons over the producer's base sales, $0.075 may be collected for each gallon sold to an alcohol blender that is in excess of the producer's base sales (up to 15,000,000 gallons). Producers who start production on or after July 1, 2001, and who have sold at least 5,000,000 gallons to an alcohol blender may receive $0.075 for each gallon sold (up to 15,000,000 gallons).

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Regional Biofuels Promotion Plan

Kansas has joined Indiana, Iowa, Michigan, Minnesota, Ohio, South Dakota, and Wisconsin in adopting the Energy Security and Climate Stewardship Platform Plan (Platform), which establishes shared goals for the Midwest region, including increased biofuels production and use. Specifically, the Platform sets the following goals:

- Produce commercially available cellulosic ethanol and other low-carbon fuels in the region by 2012;
- Increase E85 availability at retail fueling stations in the region to 15% of stations by 2015, 20% by 2020, and 33% of all fueling stations in the region by 2025;
- Reduce the amount of fossil fuel that is used in the production of biofuels by 50% by 2025;

- By 2025, at least 50% of all transportation fuels consumed by the Midwest will be from regionally produced biofuels and other low-carbon transportation fuels.

The Platform also establishes a regional biofuels corridor program. The program directs state transportation, agriculture, and regulatory officials to develop a system of coordinated signage across the region for biofuels and advanced transportation fuels and to collaborate to create regional E85 corridors. The program requires standardized fuel product coding at fueling stations as well as increased education for retailers about converting existing fueling infrastructure to dispense E85. The state transportation, agriculture, and regulatory officials are required to report their corridor implementation plans to the Midwest Governors Association by April 1, 2008.

Idle Reduction Weight Exemption

Any vehicle or combination of vehicles equipped with idle-reduction technology may exceed the state's gross and axle weight limits by up to 400 pounds to compensate for the additional weight of the added idle reduction technology.

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E85 Tax Rate Reduction and Definition

Effective January 1, 2007, the motor vehicle fuel tax rate on E85 fuel is at least $0.17 per gallon, until July 1, 2020. On and after July 1, 2020, the tax on E85 fuel will be a minimum of $0.11 per gallon. E85 is defined as an alternative fuel that is a blend of denatured ethanol and hydrocarbon that typically contains 85% ethanol by volume, and must contain at least 70% ethanol by volume and complies with American Society for Testing and Materials (ASTM) specification D5798-99.

Biofuels Use

A 2% or higher blend of biodiesel must be purchased for use in state-owned diesel powered vehicles and equipment, where available, as long as the incremental price of biodiesel is not more than $0.10 per gallon as compared to the price of diesel fuel. Further, individuals operating state-owned motor vehicles must purchase fuel blends containing at least 10% ethanol, as long as these fuel blends are not $0.10 per gallon more than the current price per gallon of regular gasoline fuel.

Low-Speed Vehicle Access to Roadways

A low-speed vehicle is defined as any four-wheeled electric vehicle whose top speed is greater than 20 miles per hour (mph) but not greater than 25 mph and is manufactured in compliance with the national highway and traffic safety administration standards for low-

speed vehicles in Title 49 of the Code of Federal Regulations Title 49, Part 571.500. Low-speed vehicles may only travel on roads with a posted speed limit of 40 mph or less and must be appropriately licensed.

Appendix D

Kansas Gas Service CNG/Gasoline Comparison

Month/Year	SSCPL Index $/Mcf	Marketer Margin* $/Mcf	KGS Delivery** $/Mcf	Gas Cost $/Mcf	CNG/gal $/GGE	Fed Tax $/GGE	Fed Cred $/GGE	State Tax $/GGE	Total $/GGE		Kansas Unleaded Avg***
Aug-2006	$6.2300	$ 0.5000	$ 0.7500	$ 7.4800	$ 0.8976	$ 0.1830	$ (0.5000)	$ 0.2300	$ 0.8106		$ 2.9800
Sep-2006	$5.7200	$ 0.5000	$ 0.7500	$ 6.9700	$ 0.8364	$ 0.1830	$ (0.5000)	$ 0.2300	$ 0.7494		$ 2.3900
Oct-2006	$3.4900	$ 0.5000	$ 0.7500	$ 4.7400	$ 0.5688	$ 0.1830	$ (0.5000)	$ 0.2300	$ 0.4818		$ 2.1700
Nov-2006	$6.3700	$ 0.5000	$ 0.7500	$ 7.6200	$ 0.9144	$ 0.1830	$ (0.5000)	$ 0.2300	$ 0.8274		$ 2.1900
Dec-2006	$6.7100	$ 0.5000	$ 0.7500	$ 7.9600	$ 0.9552	$ 0.1830	$ (0.5000)	$ 0.2300	$ 0.8682		$ 2.2200
Jan-2007	$5.5000	$ 0.5000	$ 0.7500	$ 6.7500	$ 0.8100	$ 0.1830	$ (0.5000)	$ 0.2300	$ 0.7230		$ 2.0200
Feb-2007	$7.0100	$ 0.5000	$ 0.7500	$ 8.2600	$ 0.9912	$ 0.1830	$ (0.5000)	$ 0.2300	$ 0.9042		$ 2.2000
Mar-2007	$6.6700	$ 0.5000	$ 0.7500	$ 7.9200	$ 0.9504	$ 0.1830	$ (0.5000)	$ 0.2300	$ 0.8634		$ 2.5100
Apr-2007	$6.0800	$ 0.5000	$ 0.7500	$ 7.3300	$ 0.8796	$ 0.1830	$ (0.5000)	$ 0.2300	$ 0.7926		$ 2.7600
May-2007	$6.6400	$ 0.5000	$ 0.7500	$ 7.8900	$ 0.9468	$ 0.1830	$ (0.5000)	$ 0.2300	$ 0.8598		$ 3.1900
Jun-2007	$6.9200	$ 0.5000	$ 0.7500	$ 8.1700	$ 0.9804	$ 0.1830	$ (0.5000)	$ 0.2300	$ 0.8934		$ 3.0200
Jul-2007	$6.1100	$ 0.5000	$ 0.7500	$ 7.3600	$ 0.8832	$ 0.1830	$ (0.5000)	$ 0.2300	$ 0.7962		$ 3.1000
								Avg	$ 0.7975		$ 2.5625
								Difference	**$ 1.7650**		

* Assumption for illustration only
** Does not include $38.50 monthly service charge
*** AAA

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